MSDTU01-A

2Megabit SDSL MODEM

xDSL SERIES

SDSL CSU
Fractional Nx64
G.703 E1 Interface

User's Manual

Version 1.1

CTC union Technologies Co.,Ltd.

Contents

Version History

V1.0 released May 7, 2001

V1.1 released September 24, 2001

    firmware 1.14, supports connection to datacom unit

Version 1.1

Overview

The **MSDTU01-A/E1** SDSL with G.703 Fractional E1 interface is a data access Channel Service Unit modem with the latest multi-rate HDSL (High-speed Digital Subscriber Line) technology offering both long range and high speed data transmission with Nx64 rates from 128Kbps up to 2048Kbps. The transmitting data rate may be adapted for the best "rate vs. range" performance for efficient and stable data transmission.

The **MSDTU01-A/E1** uses the 2B1Q line code with echo cancellation to transmit its high data rate over a single twisted pair of telephone wires without being affected by bridge taps or mixed cable links. It also provides high immunity to background noise and enables transmission over multiple pair cables.

Features

- ▸ High speed SDSL transport over single twisted Copper pair telephone lines
- ▸ 2B1Q line code
- ▸ Symmetrical Multi-rate Nx64 data transmission from 128Kbps to 2048Kbps
- ▸ G.703 E1 operates from recovery (E1 at CO), or loop recovery (E1 at RT) timing modes
- ▸ Simple operation
- ▸ Low power consumption
- ▸ Transparent data over SDSL
- ▸ Point-to-point data transmission service
- ▸ Configure and Loop Test via RS-232 Craft port
- ▸ Local and remote loopback features
- ▸ Integral BERT generator

Applications

Application : Point-to-Point Connection for Network Extension

Application : Point-to-Point Connection with V.35 Data Com Unit
(Must be at least version 1.4 firmware.)

Specifications

Item		MSDTU01-A/E1
Channel Port	Interface	ITU-T G.703 E1
	Connector	BNC(x2) unbalanced, RJ-45 Balanced
	Impedance	75 or 120 Ohms, selectable
	Tx Level	75 Ohm: Pulse 2.37V nominal 120 Ohm: Pulse 3.00V nominal
	Relative Rx Level	0 to –43dB
	Bit Rate	2.048Mbps
	Line Code	HDB3
	Framing	Unframed, CAS, CCS, CRC4 On/Off
	Timing Source	Recovery at CO, DSL Loop Recovery
	Jitter Tolerance	Meets ITU-T G.823
	Complies with	ITU-T G.703, G.704, G.706, G.732
WAN Port -- SDSL Line I/F	Transmission Rate :	144 Kbps – 2320 Kbps
	Data Rate :	144 Kbps – 2320 Kbps
	Line Code	2B1Q
	Line Impedance	135 Ω
	Test Standard	ANSI T1E1.413/94-006; ETSI ETR 152
	Connection Loops	One Pair (2-wire)
	Connector	RJ-11
Indicators LED	Power (WAN)	Green LED, indicate power and operation
	LOS	Red LED, DSL Loss of Signal
	LFA	Red LED, DSL Loss of Frame Alignment
	ALARM	Red LED, DSL Test & Error status
	LOOP	Red LED, DSL in Loopback mode
	(E1)	
	SigLoss	Red LED, E1 Signal Loss
	SyncLoss	Red LED, E1 Sync Loss
	ALARM	Red LED, E1 Alarm
	LOOP	Red LED, E1 in Loopback mode
OAM&P	Local	ASCII Terminal via EIA RS-232 Port
Environment	Temperature Humidity	0°C ~ 50°C 5% ~ 95%
Dimensions (WxDxH)	CO/RT	213(w)mm X 152(d)mm X 25(h)mm
Electrical	Power Input Power Consumption	12VDC via AC Adapter Less than 8 Watts

Packing

This package shall contain the following items:

1. **MSDTU01-A/E1** unit

2. AC Adapter (120VAC for North America, and 220-240VAC for Europe)

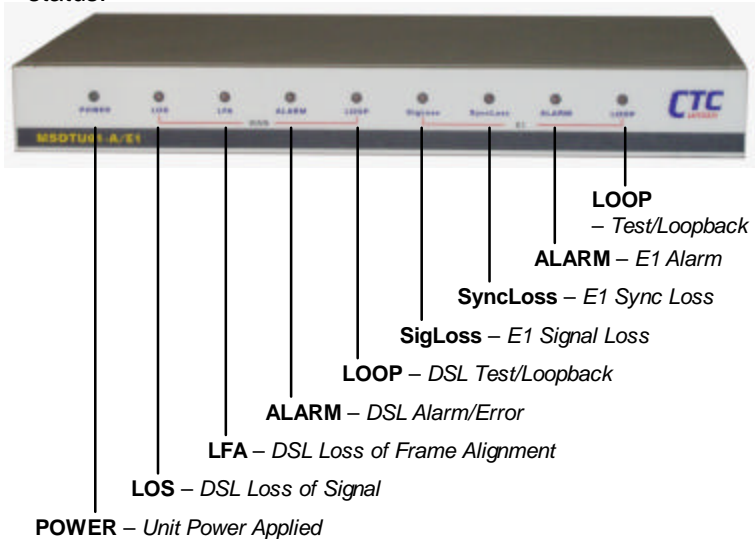3. RS-232 Serial Cable, DB-9 to DB-9(optional)
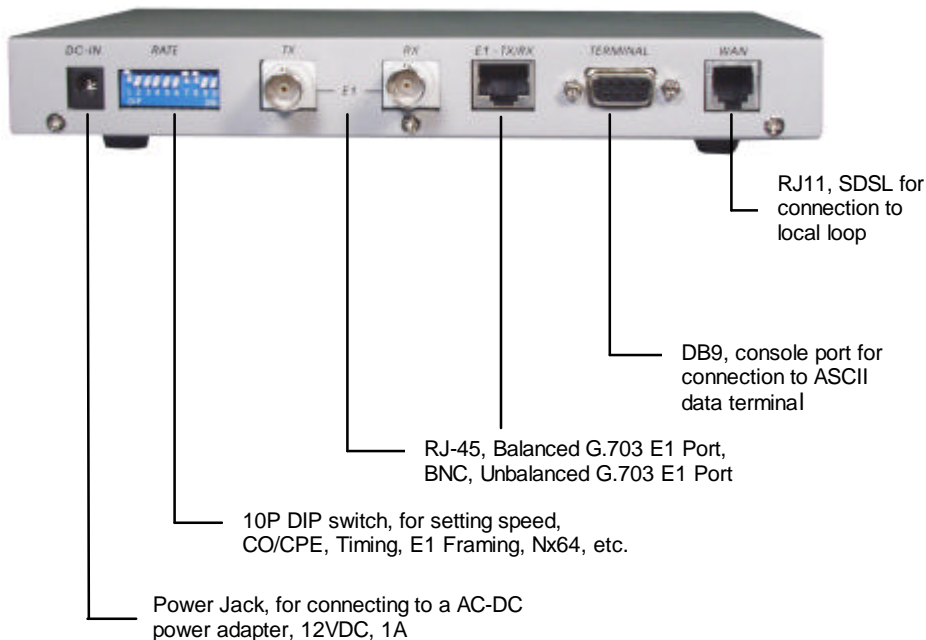

4. This User's Guide

Appearance

Front Panel

After connecting all cables and powering on the ***MSDTU01-A/E1***, LED's on the front panel shall indicate the following status.

LOOP – *Test/Loopback*

ALARM – *E1 Alarm*

SyncLoss – *E1 Sync Loss*

SigLoss – *E1 Signal Loss*

LOOP – *DSL Test/Loopback*

ALARM – *DSL Alarm/Error*

LFA – *DSL Loss of Frame Alignment*

LOS – *DSL Loss of Signal*

POWER – *Unit Power Applied*

The LED indicators provide an excellent indication of the communication status and possible link trouble locations when troubleshooting "link-down" problems.

Rear Panel

RJ11, SDSL for
connection to
local loop

DB9, console port for
connection to ASCII
data terminal

RJ-45, Balanced G.703 E1 Port,
BNC, Unbalanced G.703 E1 Port

10P DIP switch, for setting speed,
CO/CPE, Timing, E1 Framing, Nx64, etc.

Power Jack, for connecting to a AC-DC
power adapter, 12VDC, 1A

Important Safety Instructions

The following safety instructions apply to the **MSDTU01-A/E1**:

1. Be sure to read and follow all warning notices and instructions.

2. The maximum recommended ambient temperature for **MSDTU01-A/E1** is 40? (104?) Care must be taken to allow sufficient air circulation or space between units when the **MSDTU01-A/E1** is installed inside a closed rack assembly. The operating ambient temperature of the rack environment might be greater than room temperature.

3. Installation in a rack without sufficient air flow can be unsafe.

4. Racks should safely support the combined weight of all equipment.

5. The connections and equipment that supply power to the **MSDTU01-A/E1** should be capable of operating safely with the maximum power requirements of the **MSDTU01-A/E1**. In the event of a power overload, the supply circuits and supply wiring should not become hazardous. The input rating of the **MSDTU01-A/E1** is printed on the nameplate.

6. The AC adapter must plug in to the right supply voltage, i.e. 120VAC adapter for North America and 230VAC adapter for Europe. Be sure the supplied AC voltage is correct and stable. If the input AC voltage is more than 10% lower than the standard may cause malfunction of the **MSDTU01-A/E1** unit.

7. Installation in restricted access areas must comply with Articles 110-16, 110-17, and 110-18 of the national Electrical Code, ANSI/NFPA 70.

8. Do not allow anything to rest on the power cord of the AC adapter, and do not locate the product where anyone will walk on the power cord.

9. Do not service the product by yourself. Opening or removing covers can expose you to dangerous high voltage points or other risks. Refer all servicing to qualified service personnel.

10. Generally, when installed in the final configuration, the product must comply with the applicable safety standards and regulatory requirements of the country in which it is installed. If necessary, consult the appropriate regulatory agencies and inspection authorities to ensure compliance.

11. A rare condition can create a voltage potential between the earth
     grounds of two or more buildings. If products installed in separate
     building are interconnected, the voltage potential can cause a
     hazardous condition. Consult a qualified electrical consultant to
     determine whether or not this phenomenon exists and, if necessary,
     implement corrective action before interconnecting the products. If the
     equipment is to be used with telecommunications circuit, take the
     following precautions:

‣ Never install telephone wiring during a lightning storm.

‣ Never install telephone jacks in wet location unless the jack is specially
   designed for wet location.

‣ Never touch uninsulated telephone wires or terminals unless the
   telephone line has been disconnected at the network interface.

‣ Use caution when installing or modifying telephone lines (other than a
   cordless telephone) during an electrical storm. There is a remote risk of
   electric shock from lightning.

‣ Do not use a telephone or other equipment connected to telephone
   lines to report a gas leak in the vicinity of the leak.

Installation

1. Connect the local loop (twisted copper pair telephone wire) to the WAN port at the RJ-11 jack. Be sure that this local loop has been properly connected to another **MSDTU01-A/E1** remote unit.

2. Connect the E1 transmission line to the modem at the BNC connectors marked "TX" and "RX". Alternately, connect the twisted pair E1 cable to the RJ-45 connector. Please refer to the section on "Cables" for detailed pin assignment.

3. Power connection --

- **Warning : Do not apply the AC power before all the connections above have been connected.**

- Connect the DC jack to the DC-IN of the unit

- Plug in the AC Adapter to the wall AC socket

4. Terminal Connection --

- A data terminal or PC with emulation software can be connected to the TERMINAL port (RS-232) of the unit for configuration & monitoring purpose. Use an RS-232 serial cable to connect to a ASCII data terminal. The TERMINAL should be VT-100 compatible.

Hardware Setup

DSL rate and terminal type can be set up by adjusting the 10-pole DIP switch on the rear panel. Sw. 1 is for SDSL termination type, Sw.2 thru Sw. 6 are for adjusting the E1 and DSL rate, Sw. 7 will disable TS0, Sw. 8 and Sw. 9 set E1 frame mode, and Sw. 10 sets the E1 line termination.
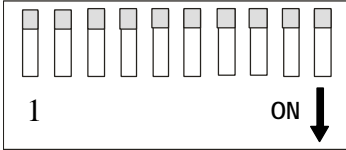
1.   Rate Setting Table

E1 Rate (TS0+data)	No.2	No.3	No.4	No.5	No.6	TS used for data	DSL Rate	TS0 Dis. DSL Rate
128K	ON	OFF	OFF	OFF	OFF	1	144K	114K
192K	OFF	ON	OFF	OFF	OFF	2	208K	144K
256K	ON	ON	OFF	OFF	OFF	3	272K	208K
320K	OFF	OFF	ON	OFF	OFF	4	336K	272K
384K	ON	OFF	ON	OFF	OFF	5	400K	336K
448K	OFF	ON	ON	OFF	OFF	6	464K	400K
512K	ON	ON	ON	OFF	OFF	7	528K	464K
576K	OFF	OFF	OFF	ON	OFF	8	592K	528K
640K	ON	OFF	OFF	ON	OFF	9	656K	592K
704K	OFF	ON	OFF	ON	OFF	10	720K	656K
768K	ON	ON	OFF	ON	OFF	11	784K	720K
832K	OFF	OFF	ON	ON	OFF	12	848K	784K
896K	ON	OFF	ON	ON	OFF	13	912K	848K
960K	OFF	ON	ON	ON	OFF	14	976K	912K
1024K	ON	ON	ON	ON	OFF	15	1040K	976K
1088K	OFF	OFF	OFF	OFF	ON	16	1104K	1040K
1152K	ON	OFF	OFF	OFF	ON	17	1168K	1104K
1216K	OFF	ON	OFF	OFF	ON	18	1232K	1168K
1280K	ON	ON	OFF	OFF	ON	19	1296K	1232K
1344K	OFF	OFF	ON	OFF	ON	20	1360K	1296K
1408K	ON	OFF	ON	OFF	ON	21	1424K	1360K
1472K	OFF	ON	ON	OFF	ON	22	1488K	1424K
1536K	ON	ON	ON	OFF	ON	23	1552K	1488K
1600K	OFF	OFF	OFF	ON	ON	24	1616K	1552K
1664K	ON	OFF	OFF	ON	ON	25	1680K	1616K
1728K	OFF	ON	OFF	ON	ON	26	1744K	1680K
1792K	ON	ON	OFF	ON	ON	27	1808K	1744K
1856K	OFF	OFF	ON	ON	ON	28	1872K	1808K
1920K	ON	OFF	ON	ON	ON	29	1936K	1872K
1984K	OFF	ON	ON	ON	ON	30	2000K	1936K
2048K	ON	ON	ON	ON	ON	31	2064K	2000K
Unframed	OFF	OFF	OFF	OFF	OFF	32	2064K	2064K

The E1 data rate is equal to the number of timeslots used for data times 64 Kbps, plus 64 Kbps for timeslot zero (framing timeslot).

The DSL data rate is equal to the E1 data rate plus 16 Kbps overhead.

The TS0 Dis. (Timeslot zero disabled) DSL rate is equal to the number of timeslots used for data plus 16 Kbps overhead. Use this rate setting to match a remote datacom unit's HDSL rate (CCS framing ONLY).

2.   CO/RT configuration

Terminal type	DIP SW No. 1
CO	ON
RT	OFF

3.   Framing, CRC4 and termination configuration

	Sw. 7*	Sw. 8	Sw. 9	Sw. 10
	TS0	Frame Mode	CRC4	E1 Term.
ON	Disable	CAS**	CRC4 On	75 Ohms
OFF	Enable	CCS***	no CRC4	120 Ohms

* Normal operation with two MSDTU01A/E1 units enable timeslot zero (TS0). (Please refer to the first application on page 4). If the MSDTU01A/E1 unit is connected over DSL to an MSDTU01A (refer to the second application on page 4) datacom unit (V.35, X.21, RS-530 or RS-449), then follow these rules.

1. Unframed E1: Enable TS0 and set E1 rate to "Unframed", set remote datacom unit's HDSL rate to 2064Kbps (data rate + 16Kbps).

2. CCS framing: Disable TS0 and match the "TS0 Dis" rate to the remote datacom unit's "HDSL rate" (data rate + 16Kbps). When timeslot zero is disabled, the unit allows E1 data to transmit transparently to the datacom side. The E1 side will not send TS0 to the far Datacom. Likewise, the E1 unit will regenerate TS0 from the Datacom side to send to the connected E1 equipment.

3. CAS framing: Not support when connected to remote datacom unit.

**CAS mode may also be referred to as PCM30. In this mode, both timeslots 0 and 16 are used for frame alignment and signaling. Other timeslots are available to carry data.

***CCS mode may also be referred to as PCM31. In this mode, timeslot 0 is used for frame alignment and all other timeslots are available to carry data.

Point-to-point Operation

1. The **MSDTU01-A/E1** should be located on each side of the connection. One side must be set to "CO" and the other side must be set to "RT". Refer to the section on "Hardware Setup" for the CO & RT setup. Place the CO side unit towards the E1 timing source.

2. Insure that both CO & RT **MSDTU01-A/E1s** are set to the same DSL rate. For example, 784Kbps.

3. Make sure that both CO & RT **MSDTU01-A/E1s** have been connected to the E1 line properly.

4. For normal operation, 75 Ohm termination should be selected (DIP sw no. 10) when connecting the E1 over unbalanced coaxial cable at the BNC connectors, while 120 Ohm termination should be selected when connecting the E1 over balanced twisted pair cabling at the RJ-45 connector. DO NOT connect E1 signals to both the BNC and RJ-45 connectors at the same time.

5. When placing the MSDTU01-A into an E1 network, the source of timing is very important. Place the MSDTU01-A unit, which is closest to the E1 timing source, in CO mode and set E1 timing to "recovery". The E1 timing will be passed to the RT unit. The E1 device connected to the RT unit will be able to recover E1 timing from the RT unit.

6. Check the WAN LED on the **MSDTU01-A/E1** -- it will remain lit when the Link is successfully established. The DSL training process may take around one minute and the WAN LED will flash during the training process.

7. After the DSL link is established, check the E1 setup. Both CO & RT side E1 must be set to use the same Frame Type. Both side E1 must also set the same E1/DSL rate parameter. Otherwise, they may fail to communicate with each other even though the DSL link is ready.

8. Follow the DSU/CSU manual to set the Frame type, clock source and other parameters. When the E1 parameters are properly set, you are ready to use the high-speed connection between the two networks. You may test the data transportation speed by using the internal BERT generator and loopback commands.

Console Operation

Starting Hyper-Terminal (on Windows 95 or Windows NT)

To Start the Hyper-terminal, following the steps below:

1. Start "Hyper-terminal" program --
    − On Windows 95 or Windows NT : start Tool Bar → Program → Accessory → Hyper Terminal Group → Double Click Hypertrm.exe → Enter Connection Name → Select Icon → Click OK
2. Select COM port to communicate with the ***MSDTU01-A/E1*--**
    − Choose direct to COM1 or COM2 → click OK
3. Set up Port Properties --
    ■ Port Setting :
      − Bit per second : 9600
      − Data bits : 8
      − Stop bits : 1
      − Parity bit: None
      − Flow Control : None
    ■ Settings :
      − Function, arrow, and ctrl keys act as : Windows keys
      − Emulation : Auto-detect
      − Back-scroll buffer lines : 500
    ■ ASCII Setup:
      − Echo typed characters locally
      − Line delay : 0 milliseconds
      − Character line feeds t incoming line ends : enable

Console Operation / Configuration

1.1   Turn on the power of **MSDTU01-A/E1** and press any key, the initial
      terminal screen will be displayed. From any other menu, pressing ESC
      and Enter will return to the top menu screen. Pressing "zero" will exit
      any menu to the next higher level. :

```
           [MSDTU-01A]
1. xDSL status
2. BERT
3. Loopback Test
4. Information
      Select Number :
```

2.1   Information display—Press "4" to display information

```
      << Information >>
Firmware Version : 1.14
Hardware Version : 1.1
FPGA Version : 1

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http://www.ctcu.com/
```

The firmware version, hardware version and FPGA version will be
displayed. This information should be readily available to give to
technical support in the event there are difficulties in configuring or
applying the units.

3.1   xDSL status display --

```
      << Status >>
Terminal  Type : HTU-C
Symbol Rate : 336Kbps
In Sig Level : 015dB
Far-End Signal  Atten. : 002dB
Noise Margin :-15.5dB
Tx Gain : -0.48dB
```

Descriptions of xDSL status items --

3.1.   Terminal Type : Indicates whether the Terminal Type of this unit is
       set for Central Office (HTU-C) or Remote Terminal (HTU-R). In point-
       to-point operation, one unit must be set to CO while the other must
       be set to RT.

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3.2.   Symbol Rate : Indicates the DSL rate in kilobits per second. This is normally the data rate plus 16Kbps overhead.

3.3.   In Sig Level : Indicates the input signal level of the DSL signal.

3.4.   Far-End Signal Atten. : An approximate calculation of overall cable signal attenuation in dB.

3.5.   Noise Margin : Shows Noise Margin value. The noise margin is defined as the maximum tolerable increase in external noise that still allows for a BER (bit error rate) of less than 10^{-7}.

3.6.   Tx Gain : Shows current transmission gain level in decibels. Nominal transmit power is 13.5dBm, while Tx gain may vary from –1.6dB to +1.4dB.

4.1   Select "3" Loopback Test

```
        << Loopback >>

*1. OFF        4. Isolated
 2. PCM-PCM   5. HDSL-PCM
 3. Analog    6. Remote Line


    Select Number : _
```

4.1.   Item "1" OFF, will turn off any loopback mode.

4.2.   Item "2" PCM-PCM, turns on PCM-PCM loopback mode. In this mode, the E1 signal coming in the Rx terminal is looped to the E1 Tx terminal.

4.3.   Item "3" Analog, turns on analog loopback mode. In this mode the local DSL Tx is looped back to local Rx. The DSL cable MUST be disconnected.

4.4.   Item "4" Isolated, turns on isolated analog loopback. This loopback is the same as item "3", except the DSL cable need not be disconnected.

4.5.   Item "5" HDSL-PCM, turns on digital loopback. In this mode the remote received DSL signal is looped back to the remote unit.

4.6. Item "6" Remote Line, turns on remote digital loopback. This mode is
used to test the DSL link.The local unit sends a command to the
remote unit which then initiates its own HDSL-PCM loopback. This
mode requires that an active DSL link already be established.
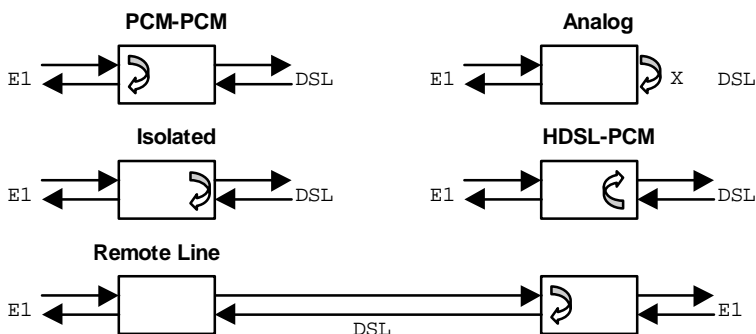

Figure examples of Loop back modes

5.1   Select "2" BERT

```
        << BERT >>
1. Function
2. Pattern
3. Scale
4. BERT Status

    Select Number :
```

5.1. BERT – Function : Selects the mode of Loop Back testing.

```
       << BERT Function >>
*1. OFF
 2. Normal
 3. PCM Framed
 4. PCM Serial

    Select Number :
```

Normal mode selects the selected HDSL payload on a per-timeslot-basis.
PCM Framed BERT tests only the selected PCM timeslots, while PCM Serial
tests the entire PCM channel.

5.2. BERT – Pattern : There are four patterns available for BER Testing;
      2e4-1, 2e15-1, QRSS, and 2e23-1

```
       << BERT Pattern >>
*1. 2e4-1
 2. 2e15-1
 3. QRSS
 4. 2e23-1

    Select Number :
```

5.3. BERT – Scale : Test duration in bits transmitted.

```
       << BERT Scale >>
*1. 2^21
 2. 2^25
 3. 2^28
 4. 2^31

    Select Number :
```

5.4. BERT – Status :

```
        << BERT Status >>

Pattern SYNC : SYNC
Measurement : Complete
Bit Errors : 000

Press '1' to review.
```

This display is used to review the results of testing. If there is no pattern sync the display will read "No SYNC". During the testing process the display will read "In Progress". The accummulated or final number of errors will be displayed. The register for counting errors is only 8 bits (256) and will increment back to zero when full.

Cables / Connectors

1. RS-232 Cable for connection to VT-100 type ASCII terminal
▸ TERMINAL (CRAFT) Port DB-9 DCE connector pin assignment, signal direction, and alarm relay contacts:

                – Pin 2 ------ RXD   →   **DTE**
MSDTU01-A   – Pin 3 ------ TXD   ←
                – Pin 5 ------ SGND
                – Pin 6 ------ Alarm relay common
                – Pin 4 ------ Alarm relay NC (open on alarm)
                – Pin 9 ------ Alarm relay NO (closed on alarm)
▸ Parameter :
         – Data Speed : 9600 bps
         – Parity : None
         – Stop Bit : 1 bit
   – Character Length : 8 Bits
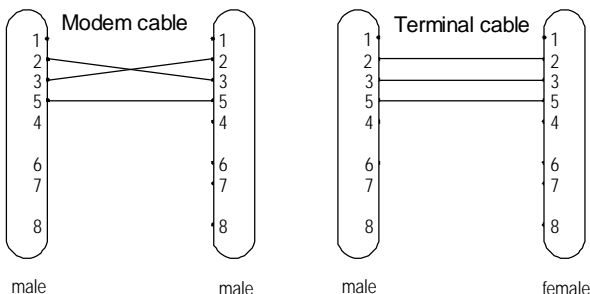
E1 BNC Connectors

BNC	Pin	Designation	Direction	Function
TX	Center	TTIP	From *MSDTU01-A*	Transmit data
	Sleeve	TRING	«	Signal return
RX	Center	RTIP	To *MSDTU01-A*	Receive data
	Sleeve	RRING	«	Signal return
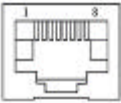
E1 RJ-45 Connector

RJ-45	Pin	Designation	Direction	Function
GND	8	GND	«	Frame Ground
	7	GND	«	Frame Ground
TX	4	TTIP	From *MSDTU01-A*	Transmit data +
	5	TRING	From *MSDTU01-A*	Transmit data -
RX	1	RTIP	To *MSDTU01-A*	Receive data +
	2	RRING	To *MSDTU01-A*	Receive data -
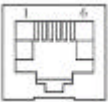
WAN DSL Connector

Conn.	Pin	Designation	Direction	Function
TX/RX	3	TIP	«	Transmit data
	4	RING	«	Signal return

DC - IN Connector
    TIP ---- DC12V+
    RING – Return (-)